a preheater in communication with the oxidation chamber inlet, the preheater capable of increasing the temperature of the oxidant to a temperature resulting in the combined oxidant and fuel from the fuel nozzle closest to the oxidation chamber inlet being [greater] hotter than the autoignition temperature of the combined oxidant and fuel from the fuel nozzle closest to the oxidation chamber inlet; and

a process chamber in a heat exchange relationship to the oxidation [reaction] chamber wherein the heat transferred from the oxidation [section] chamber does not [causes] cause the temperature of the mixture within the oxidation [reaction] chamber in the vicinity of each fuel nozzle to decrease below the autoignition temperature of the combined mixture in the oxidation chamber in the vicinity of that fuel nozzle and the fuel noxxles are capable of distributing fuel into the oxidation chamber without forming a flame.

Amend claim 2 by inserting, on line 2, before "communication" , --fluid--.

Add new claims 13-15 as follows:

13. The process heater of claim 1 wherein the process comprises an endothermic chemical reaction.
14. The process heater of claim 1 wherein the process is a vacuum flash distillation feed heater.
15. The process heater of claim 1 wherein the process is a hydrocarbon distillation column reboiler.

In the Specification:

On page4, line 24, before "mixed", delete "is" and insert –are--.

REMARKS

Claims 1-7 and 13 remain in the present application. Claims stand as rejected under 35 U.S.C. 112, second paragraph and 35 U.S.C. 103(a). The above amendment adds a limitation that the fuel nozzles mix fuel with oxidant without forming a flame, and corrects indefinite claim language. Claim 13 is added specifically claiming endothermic reaction processes. Support is found in the specification, for example on page 4, lines 26 through line 4 of page 5, and on page 5, lines 10-15. Claim 14 is added specifically claiming use of the present invention with a vacuum flash distillation feed heater. Claim 15 is added specifically claiming use of the present invention with a hydrocarbon distillation column reboiler. Support for claims 14 and 15 is found in the specification on page 14, lines

Claims are rejected under 35 U.S.C. 112, second paragraph based on "oxidation chamber" and "oxidation reaction chamber" being used inconsistently in the claim, a word being missing with respect to the temperature of the mixture of the combined oxidant and fuel, and a typographical error with respect to "causes" on line 14 of claim 1, and in claim 2, the "kind" of communication not being clear. The above amendments eliminate these problems. This rejection is therefore respectfully traversed and withdrawal thereof is respectfully requested.

Claims are rejected under 35 U.S.C. 103(a) based on Minet et al. in view of Mikus. Minet suggests a process heater that utilizes indirect heating to eliminate hot spots caused by radiated heat, and Mikus teaches a flameless combustor. The present invention, as it is now claimed is a flameless combustor as a process heater. To the extent the references contain a prima facia basis for a rejection under 35 U.S.C. 102(a), the specification contains evidence of nonobviousness that overcomes the prima facia basis for the rejection. The paragraph starting at the bottom of page 4 of the present specification describes how when applied to endothermic reactions can achieve improved conversions, selectivities and/or yields and reduced byproducts because of uniform heat inputs and reduced hot spots due to the use of the flameless combustion process. On page 5, lines 10-15 it is described how interstage reheats can be eliminated, and thus enabling operation at an optimum temperature. On page 7, lines 22-24, the advantage of even temperature profiles with respect to materials of construction is discussed. Advantages particular to the present invention applied to a styrene production by ethylbenzene dehydrogenation is discussed on page 13, lines 11-21. It is pointed out that undesirable byproducts such as coke and cracked byproducts increase rapidly as the reaction temperatures increase, and conversions decrease as temperatures below the optimum temperatures are used. Prior art styrene processes utilize fixed bed catalyst reactors with one or more reheat furnaces to add back endothermic heat of reaction. The present invention allows the reactor to be almost isothermal, and thus gaining the benefits of operation at an optimum temperature. On page 14, lines 10-13, the benefits particular to the present invention applied to a steam methane reforming application are discussed. Because hydrogen purity is dictated by the temperature of the reaction, and typical prior art steam methane furnaces have burners, maximum tube skin temperatures limit the purity and/or limit the minimum steam required. With the present invention, average process temperatures can be considerably higher because the reactor tubes are of uniform temperature. Thus either less volume of catalyst, higher purity, less steam, or a combination of these advantages can be realized. Advantages for application to thermal cracking of hydrocarbons and vaporizing hydrocarbons are discussed on page 14, line 27 through line 2 of page 15. In these applications, coke forms quickly at hot spots and therefore tube skin temperatures need to be kept low enough so that the hottest tube skins locations do not form coke on the process side. Thus, with the uniform heat fluxes possible with the present invention, higher heat fluxes are possible.

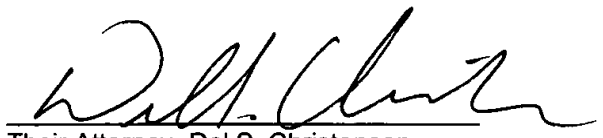
The indirect fired heaters such as that suggested by Minet et al. address the problem of the hot spots on furnace tubes, but a separate heater is required for reheat, and isothermal processes, or nearly isothermal processes are not possible.

These significant advantages address problems long standing in the art, and are not suggested by the references of record. Any prima facia basis for rejection under 35 U.S.C. 103(a) is therefore overcome by these references, and withdrawal of this rejection is respectfully requested.

Each of the rejections having been traversed, allowance of the remaining claims is respectfully requested. If the Examiner would like to discuss this application, it is respectfully requested that the undersigned by contacted at (713) 241-3997.

Respectfully submitted,

Rashmi K. Shah et al.

By: 

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Enclosure: duplicate of petition to extend time for response